

WHAT IS CLAIMED IS:

- 1 1. A method for contracting collagen tissue at a target site on or
2 within a patient's body comprising:
3 heating an electrically conducting fluid in the region of the target site; and
4 directing the heated electrically conducting fluid onto tissue at the target
5 site to induce contraction of collagen fibers in said tissue.
- 1 2. The method of claim 1 wherein the electrically conducting fluid is
2 heated to a temperature sufficient to substantially irreversibly contract the collagen fibers.
- 1 3. The method of claim 1 wherein the collagen fibers are heated to a
2 temperature in the range of about 45°C to 90°C.
- 1 4. The method of claim 1 wherein the collagen fibers are heated to a
2 temperature in the range of about 60°C to about 70°C.
- 1 5. The method of claim 1 wherein the heating step comprises applying
2 high frequency voltage to an electrode terminal in contact with the electrically conducting
3 fluid.
- 1 6. The method of claim 5 wherein the heating step further comprises
2 inhibiting electric current from contacting the tissue at the target site to minimize damage
3 to, or removal of, said tissue.
- 1 7. The method of claim 1 further comprising contacting the
2 electrically conducting fluid with a return electrode to provide a current flow path from
3 the electrode terminal, through the electrically conducting fluid, and to the return
4 electrode.
- 1 8. The method of claim 7 further comprising maintaining a space
2 between the electrode terminal and the tissue to inhibit electric current from directly
3 contacting said tissue.

1 9. The method of claim 8 wherein the space between the electrode
2 terminal and the tissue is between about 5 to 30 mm.

1 10. The method of claim 7 wherein the return electrode is positioned
2 proximal to the electrode terminal to induce current flow from the electrode terminal
3 away from the target site.

1 11. The method of claim 1 further comprising directing the electrically
2 conducting fluid along a fluid path past the electrode terminal and to the target site.

1 12. The method of 7 further comprising directing the electrically
2 conducting fluid past the return electrode to generate the current flow path between the
3 return electrode and the electrode terminal.

1 13. The method of claim 7 further comprising supplying the electrically
2 conductive fluid to a proximal end of an axial lumen defined by the return electrode and
3 directing the fluid through a distal end of the axial lumen to the electrode terminal.

1 14. The method of claim 5 further comprising immersing the target site
2 within a supply of the electrically conductive fluid and heating the electrically conducting
3 fluid in the region of the electrode terminal sufficiently to propel the heated electrically
4 conducting fluid away from the electrode terminal to the target tissue.

1 15. The method of claim 14 further comprising positioning a return
2 electrode within the supply of electrically conductive fluid to generate the current flow
3 path between the target site and the return electrode.

1 16. The method of claim 1 wherein the electrode terminal comprises an
2 electrode array including a plurality of electrically isolated electrode terminals.

1 17. The method of claim 1 further comprising:

2 supporting the electrode terminal with an electrosurgical probe having a
3 tissue treatment surface near a distal end of the probe, wherein the electrode terminal is
4 substantially flush with the tissue treatment surface.

1 18. The method of claim 1 further comprising applying RF frequency
2 voltage to a plurality of electrically isolated electrode terminals within the electrically
3 conducting fluid.

1 19. The method of claim 18 further comprising independently
2 controlling current flow from at least two of the electrode terminals based on impedance
3 between the electrode terminal and a return electrode.

1 20. The method of claim 1 wherein the electrically conductive fluid
2 comprises isotonic saline.

1 21. The method of claim 1 further comprising applying RF frequency
2 voltage to at least one electrode terminal within the electrically conducting fluid, the
3 voltage being in the range of about 20-90 volts rms.

1 22. A method for contracting collagen tissue at a target site on or within a
2 patient's body comprising:

3 positioning a tissue treatment surface of an electrode terminal in close
4 proximity to the target site in the presence of an electrically conducting fluid;

5 contacting the electrically conducting fluid with a contact surface of a
6 return electrode to generate a current flow path between the electrode terminal and the
7 return electrode; and

8 applying high frequency voltage to the electrode terminal and the return
9 electrode, the voltage being sufficient to induce a contraction of collagen fibers at the
10 target site without causing dissociation or molecular breakdown of the collagen fibers.

1 23. The method of claim 22 further comprising controlling a depth of
2 tissue penetration of the electric current into the tissue to control a depth of thermal
3 heating of said tissue.

1 24. The method of claim 23 wherein the controlling step is carried out
2 by controlling a frequency of the voltage applied to the electrode terminal and the return
3 electrode.

1 25. The method of claim 23 wherein the controlling step is carried out
2 by controlling a diameter of the electrode terminal.

1 26. The method of claim 23 wherein the electrode terminal is supported
2 at a distal end of an electrosurgical probe and the controlling step is carried out by
3 controlling a distance between an outer perimeter of the probe and the electrode terminal.

1 27. The method of claim 24 wherein the voltage has a frequency of less
2 than 350 kHz.

1 28. The method of claim 24 wherein the voltage has a frequency of
2 about 100 to 200 kHz.

1 29. The method of claim 23 wherein the depth of tissue heating is less
2 than about 3.5 mm.

1 30. The method of claim 23 wherein the depth of tissue heating is less
2 than about 0.5 mm.

1 31. The method of claim 23 wherein the controlling step further
2 comprises positioning the return electrode such that electric current flows from the
3 electrode terminal away from the target site to the return electrode.

1 32. The method of claim 22 further comprising heating the electrically
2 conductive fluid adjacent the electrode terminal with the high frequency voltage and
3 propelling the heated fluid to the tissue at the target site to apply thermal energy to the
4 tissue.

1 33. The method of claim 24 wherein the thermal energy is sufficient to
2 induce contraction of the collagen fibers at the target site and low enough to minimize
3 molecular dissociation or breakdown of the tissue.

1 34. The method of claim 22 wherein the voltage difference applied
2 between the return electrode and the electrode terminal is about 30 to 70 volts rms.

1 35. A surgical instrument for applying high frequency electrical energy
2 to tissue at a target site comprising:

3 a shaft having a proximal end and a distal end;
4 an electrically insulating support at or near the distal end of the shaft, the
5 electrically insulating support having a tissue treatment surface;
6 an electrode array comprising at least three electrode terminals at least
7 partially embedded within the electrically insulating support, wherein the electrode
8 terminals are substantially flush with the tissue treatment surface of the electrically
9 insulating support; and

10 one or more connectors extending from the electrode terminals to the
11 proximal end of the shaft.

1 36. The surgical instrument of claim 34 further comprising a return
2 electrode positioned on the shaft proximal to the electrode array.

1 37. The surgical instrument of claim 35 wherein the electrode terminals
2 are electrically isolated from each other.

1 38. The surgical instrument of claim 35 further comprising at least five
2 electrode terminals embedded within the electrically insulating support.

1 39. The surgical instrument of claim 35 wherein the electrically
2 insulating support comprises an inorganic material selected from the group consisting
3 essentially of glass, ceramic and glass/ceramics.

1 40. The surgical instrument of claim 35 wherein the return electrode is
2 a substantially annular band positioned proximal to the electrode array.

1 41. The surgical instrument of claim 35 wherein the electrode terminals
2 each have a tissue treatment surface substantially flush with the tissue treatment of the
3 electrically insulating support so as to minimize dissociation and breakdown of collagen
4 fibers in the tissue and to minimize ablation of tissue surrounding the collagen fibers

1 42. The surgical instrument of claim 41 wherein the tissue treatment
2 surfaces of the electrode terminals each have a surface area less than about 1 mm².

1 43. The surgical instrument of claim 41 wherein a distal portion of the
2 shaft is bent such that the electrode terminals have a tissue treatment surface that is non-
3 perpendicular to the longitudinal axis of the shaft.

1 44. A system for applying high frequency electrical energy to a tissue
2 at a target site comprising:

3 an electrosurgical probe having a shaft with proximal and
4 distal ends and at least one electrode terminal at or near the distal end;

5 a fluid delivery element for delivering electrically
6 conductive fluid to the target site;

7 a return electrode spaced from the electrode terminal; and

8 an electrosurgical power supply for applying high
9 frequency voltage to the electrode terminal and the return electrode, the voltage being
10 sufficient to induce contraction of collagen fibers within the tissue.

1 45. The system of claim 44 wherein the return electrode is positioned
2 to draw electric current from the electrode terminal away from the tissue at the target
3 site.

1 46. The system of claim 44 wherein the return electrode is positioned
2 on the shaft of the probe proximal to the electrode terminal

1 47. The system of claim 44 wherein the voltage is selected to heat the
2 electrically conductive fluid to a temperature sufficient to cause contraction of the
3 collagen fibers within the tissue.

1 48. The system of claim 44 wherein the voltage is selected to heat the
2 collagen fibers to a temperature of about 60°C to 70°C.

1 49. The system of claim 44 wherein the power supply comprises means
2 for controlling a depth of penetration of electric current into human tissue.

1 50. The system of claim 44 wherein the power supply has an operating
2 frequency less than 350kHz.

1 51. The system of claim 44 wherein the power supply has an operating
2 frequency between about 100 to 200 kHz.

1 52. The system of claim 44 further comprising an array of electrode
2 terminals positioned at a distal end of the electrosurgical probe, the terminals each having
3 a diameter of less than 1 mm to about 0.05 mm.

1 53. The system of claim 44 further comprising an array of electrode
2 terminals positioned at a distal end of the electrosurgical probe, the terminals being
3 spaced at least a distance of about 0.2 mm to about 0.75 mm.